

ARI Working Papers

Fort Benning Field Unit

1987

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July 2001

United States Army Research Institute for the Behavioral and Social Sciences

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20020103 149

REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy) July 2001	2. REPORT TYPE Final	3. DATES COVERED (from... to) 1987		
4. TITLE AND SUBTITLE ARI Working Papers: Fort Benning Field Unit, 1987			5a. CONTRACT OR GRANT NUMBER	
			5b. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Dewey, G.I. and Thompson, T.J.			5c. PROJECT NUMBER	
			5d. TASK NUMBER	
			5e. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences ATTN: TAPC-ARI-PO 5001 Eisenhower Avenue Alexandria, VA 22333-5600			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences 5001 Eisenhower Avenue Alexandria, VA 22333-5600			10. MONITOR ACRONYM ARI	
			11. MONITOR REPORT NUMBER WP Benning	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.				
13. SUPPLEMENTARY NOTES ARI working papers were originally unofficial documents intended for limited distribution to obtain comments. These working papers are being archived in order to preserve material that was not included in other ARI publications. The material contained herein may not meet ARI's usual scientific or professional standards for publication.				
14. ABSTRACT (<i>Maximum 200 words</i>): One working paper dealing with unit training.				
15. SUBJECT TERMS Unit training, JRTC				
16. REPORT Unclassified			17. ABSTRACT Unclassified	
18. THIS PAGE Unclassified			19. LIMITATION OF ABSTRACT Unlimited	20. NUMBER OF PAGES 15
			21. RESPONSIBLE PERSON (Name and Telephone Number) David W. Witter (703) 617-0324	

Fort Benning Field Unit Working Paper

Dewey, G.I., & Thompson, T.J. (1987). Training, simulation, and practice: Implications for the Joint Readiness Training Center. WP FBE 87-01.

PB 881)

Working Paper 87-01

Training, Simulation, and Practice: Implications for the Joint Readiness Training Center

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February 1987

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FOREWORD

The U.S. Army Research Institute's Fort Benning Field Unit has been tasked to assist in the research effort at the newly formed Joint Readiness Training Center (JRTC), Fort Chaffee, Arkansas. This product represents a two-fold effort. The first is to characterize the JRTC, and by implication, all Advanced Collective Training Facilities (ACTFs), into either a training, practice, or simulation environment. We conclude that they are best conceived of as simulations, and cannot expect training-type results to emerge from each rotation (e.g., rapid learning). A second goal was to examine various performance evaluation models (e.g., task, condition, and standard) used at TRADOC schools for applicability to ACTFs. We propose that After Action Reviews and documentation similar to Lessons Learned should form the basis of performance evaluation at JRTC.

Work for the JRTC is being conducted as part of the U.S. Army Research Institute's Tactical Doctrine and Training for Light Infantry Task (Program Task 3.5.5) which is part of the ARI-Fort Benning Field Unit's research program. This product is intended to stimulate new thinking concerning performance evaluation and the function of ACTFs.

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TRAINING, PRACTICE, AND SIMULATION:
IMPLICATIONS FOR THE JOINT READINESS TRAINING CENTER

EXECUTIVE SUMMARY

Requirement:

This report describes three types of training procedures (training, practice, and simulation), and evaluates each in terms of applicability to the Joint Readiness Training Center (JRTC) environment. Two major questions were asked. The first was to determine how to best characterize the JRTC. An inappropriate procedural classification could lead to misconceptions about the mission of JRTC, and could lead to incorrect expectations about the degree of learning expected from units. The second question concerned the best performance feedback model to be used at JRTC and other Combat Training Centers.

Findings:

The JRTC is best thought of as a large scale, combat simulation, as opposed to a "training center" *per se*. Hence, we cannot expect rapid learning to occur at JRTC, nor can we precisely identify what will be learned during a rotation. Also, it was shown that the task-condition-standard performance evaluation model is inappropriate for Advanced Collective Training Facilities since conditions cannot be adequately specified. In addition, we argue that an improved performance feedback model must be developed and fielded to insure that soldiers from all commands reap the benefits of JRTC, not just the current rotation.

Utilization of Findings:

The findings from this product will impact future JRTC research in several ways: One, it will serve as a springboard for all future JRTC data collection efforts. In essence, the material reported here will aid in specifying a proper methodology for specifying what variables should be collected, how should they be analyzed, and what meaning they have in the larger context of JRTC. Second, we see this product as providing the rationale for investigating alternative performance feedback models. Current methods are limited along at least one critical dimension (e.g., restricted distribution or audiences). Finally, and to a lesser extent, the research direction described in this paper will help to integrate research at the various Advanced Collective Training Facilities.

TRAINING, PRACTICE, AND SIMULATION:
IMPLICATIONS FOR THE JOINT READINESS TRAINING CENTER

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TRAINING, PRACTICE, AND SIMULATION:
IMPLICATIONS FOR THE JOINT READINESS TRAINING CENTER

INTRODUCTION

"Which is the easiest and best way to feed information back?
How come our tasks aren't parallel with the evaluation (process)?"

COL Larry Word, 1987

The U.S. Army Research Institute-Fort Benning Field Unit has been given the research lead in support of activities at the newly formed Joint Readiness Training Center (JRTC), Fort Chaffee, Arkansas. Based on past training experiences and the need to establish accountability for funding and support, we are certain that the U.S. Army will be asked about the benefits from JRTC. Our major concern and global research issue is this: What do we expect of the soldier subsequent to the JRTC experience?

Phrased in other ways, what can we expect soldiers to learn and, to echo COL Word's questions, how can we best measure performance and give feedback to soldiers? Other questions follow: Is the JRTC an "adequate" simulation of combat? Can tasks, conditions, and standards (TCSs) be specified for all combat echelons? Does the focus of fidelity at leader or soldier level determine the overall effectiveness of the experience and does it determine whether the center is training or simulation oriented? As a practical consideration and research issue, how can both leaders and soldiers, often experiencing far different situations in a field exercise, both gain from activities at JRTC? Answering these questions requires a fundamental understanding of differences between training, simulation, and practice.

We believe that a closer examination of what is meant by each of these skill acquisition and sustainment procedures (training, practice, and simulation) and their relationship to the TCSs model will help us in several ways. First, this examination will force us to think about exactly what JRTC can do for soldiers and units in terms of skill acquisition and sustainment. We will be, therefore, less likely to place unrealistic expectations on JRTC and will be in a better position to assess what JRTC is truly capable of delivering in terms of training and performance evaluation. Second, a discussion of these terms can only serve to clarify some current conceptions about what constitutes training, practice, and simulation. This will clarify research issues and directions as well. Finally, we can examine the TCS model for applicability to the JRTC environment.

TRAINING, PRACTICE, AND SIMULATION

We are aware that the major role of a peace-time Army is training and sustainment of skills (FM 25-3, 1984). Clearly TRADOC schools are training oriented, as are field and classroom exercises. Our thesis, however, is that there are different types or ways of training: Some skills are best learned through a simulation of combat; some skills are best sustained through practice of only a small

component of combat. Other skills are best developed through what we will call "training" (in the sense of training novices).

We see training, practice, and simulation as employing different means or methods to produce similar ends or results. Occasionally it may be difficult to classify any one specific device or situation as being training, practice, or simulation but there are many times when the distinction is clear. It behooves us, for reasons stated below, to understand the differences among these skill acquisition and sustainment procedures. There are at least two important dimensions along which they differ. One of these dimensions deals with the type, quality, and quantity of feedback given to the soldier. We can look at the similarity of the feedback of a particular training procedure, for example, to that in the real environment. Generally we think of the world as offering little feedback. A training situation, on the other hand, should be rich in terms of soldiers knowing how they have performed. Hence, we would expect little similarity among the skill acquisition and sustainment procedures along this dimension. A second aspect concerns the expertise of the soldier in the procedure. Common sense would dictate that training is largely intended for novices, while those already having mastery of a task primarily practice it. Simulation seems to be for everybody, but why? We suggest that simulation does offer something for everybody in that basic "enabling" skills, as well as higher level, integrative skills can be learned in a simulation.

Training

A common purpose of training is simply to make a novice proficient in some task. Hopefully this can be accomplished with a minimum investment of time, effort, and other resources after an effective program has been developed and validated. Proficiency is measured by performance along some dimension of interest that has been established, to include well-defined standards and objective conditions. For example, an appropriate measure of marksmanship might be the ratio of hits to misses.

There are at least four aspects of a skill acquisition and sustainment procedure which qualify it as training. One is that the procedure is constructed in such a way that diagnostic feedback is provided to the soldier. Attempts are made to a) keep the quality of the feedback high, b) keep the frequency high, and c) insure that the soldier has no trouble discerning the value of the feedback. Instead of merely registering a rifle shot as a hit or miss, we might, immediately after firing, give the actual location of each shot to a soldier. The soldier then can clearly see the relationship of performance to the standard and can change his performance as necessary. This particular issue has been addressed in current ARI marksmanship training research.

A second general characteristic of training is that task is broken down into components. The task components receive different emphases during training, depending on whether or not they are considered "critical" task elements. These critical parts are determined through research or other means (e.g., subject matter experts), and are considered to be most important for the acquisition of skill. For example, the ability to load a magazine with ammunition is necessary for the (larger) task of marksmanship. However, in terms of training it is deemed to be non-critical; thus, it is not "trained" with the same vigor that shooting is. A third

characteristic of training is that it is repetitive. The task is performed over and over during training.

A training environment may capture the task in a very abstract way or it may be highly realistic. In either situation, however, we rely upon positive transfer of skills learned. One reality, however, is that more abstract training situations generally result in less transfer to the real task than do realistic situations.

We might summarize the previous statements like this: There is a task in which soldiers must be proficient. We are able to define with great precision the critical components of the task. We put soldiers through intensive drills with high levels of feedback (quality and quantity) so that they will learn the skills rapidly to a high degree of proficiency.

There are two words of caution about training. One, mentioned above, is that the training situation may not transfer to a real combat situation. If this occurs then the training situation must be reconfigured. Possibly, the training situation captures the real task too abstractly. A certain video game may not develop the skills necessary for coping in the real world. Alternatively, the "critical" task components being trained may be the incorrect ones, or they may have been presented incorrectly during training. A second caution is that the larger task of which individual parts were trained must be put back together at some point in time. That is, the newly trained components need to be integrated. Usually this integration does not occur spontaneously and a situation has to be provided under which integration can occur.

A shortcoming which may be more common than we care to consider is that mastery is often not achieved in training. Training, to be successful, must include the internalization (integration) of the new skill into the learner's behavioral repertoire. Whether training or practice accounts for the necessary mastery may be a fine issue; it does, however, remain a critical component of training.

Practice

Practice is the next step subsequent to training. This is the skill acquisition and sustainment procedure with which people are most familiar, and is often (erroneously) referred to as "training." After a skill has been trained soldiers need to master, or fine tune, skills and maintain proficiency over the task. Generally we practice what we have learned, and do it the same way that we trained. The major feature of practice which distinguishes it from training is that the quality and quantity of feedback is reduced. By this point soldiers know how the task is done and they recognize correct and incorrect performance. Hence, the major intent of practice is to fine tune skills. Practice is one place where performance can be legitimately examined. During training, we test for knowledge of skills; now, we examine execution of those skills.

Simulation

Simulations have a variety of functions: sometimes these functions resemble training, sometimes practice. However, as we shall see, they are neither.

One of the many functions of a simulation is to provide a testbed (possibly impoverished in terms of complexity and fidelity when compared to the real scenario) for learned skills. Hence, one important application of simulation is that skill execution can be evaluated for transfer to a novel situation. A second function of simulation is practice. It is well known that many skills deteriorate without use. Simulation provides an easy (and hopefully inexpensive) way to maintain skills. Third, and very important, a simulation environment is an appropriate context in which to encourage skill integration. Skill integration is the least teachable of all tasks: You can easily teach the components of marksmanship -- loading the rifle, aiming, pulling the trigger, but you cannot teach someone how to put them all together to produce "marksmanship." That is up to the individual.

There is another role of simulation that we as researchers are less proud of, and that is when simulation is used as training. Sometimes because of task complexity, time limitations, or other factors, it is not possible to isolate critical task components for training. The logic proceeds as follows: If we keep the simulation as realistic as possible, then critical elements of the task (whatever they are) will be trained. This is a poor alternative to training specific tasks since the simulation is not structured to maximize performance, nor is it structured to optimize quality and quantity of feedback. We are hoping that the soldier will abstract and integrate the important task components from the simulation. For this situation to have any validity at all, the simulation must be kept as realistic as possible to insure that the "correct" task elements are learned. In any case, as one can imagine, learning under these circumstances will be slow.

Simulation has several potential drawbacks. First of all there is little or no guided feedback -- that is, simulation generally provides only the feedback one would get during the actual event. Usually this type of feedback is impoverished, delayed, and infrequent. Hence, simulations are not optimal learning environments. Learning will probably occur but it will be at a reduced rate and we cannot be sure exactly what is learned (unless we test to see) since the situation is relatively unstructured (in contrast to more programmatic training). At times, learning through simulation is haphazard and coincidental. A real danger of simulation is that soldiers may learn to "beat" the simulation. That is, simulation, being unrealistic, necessarily introduces unwanted or artificial elements into the procedure. Some of these elements may be undesirable in that an understanding of the structure of the simulation might permit successful task accomplishment that truly does not mirror the actual event. Consider a simulation in which, by some oversight, soldiers had available an unlimited supply of ammunition. They would quickly learn to shoot, shoot, shoot, because there would be no associated cost (that is, expenditure of a scarce resource) as there is in the real combat situation. Hence, as researchers, we must be constantly on guard for artifacts of simulation.

PERFORMANCE EVALUATION MODELS

Historically, training and practice have been conducted within the TCS framework. We agree with the use of this model within these domains, but believe that it is an inappropriate model to use when one progresses beyond training and practice. The flaws with the TCS model are that no provision is made for task (skill) integration, nor is there any provision for performing multiple tasks

simultaneously. More important, there is no room for alternative action paths as conditions change.

Table 1 diagrams the various parameters of the TCS model with respect to the different skill acquisition and sustainment procedures. The major conclusion to be drawn is that simulation (in general) and the Advanced Collective Training Facilities (ACTFs, encompassing term for JRTC, NTC, and other training centers) are not amenable to the TCS model.

Table 1

Evaluation of the skill acquisition and sustainment procedures with respect to the three parameters of the TCS model.

Skill Acquisition and Sustainment Procedure			
	<u>Training</u>	<u>Practice</u>	<u>Simulation</u>
Task	well defined single task	well defined single task	ill defined multiple tasks, possibly conflicting
Condition	constant	constant	fluid changing resources materiel, battlefield
Standard	performance oriented easily measured	performance oriented easily measured	performance oriented measurement difficult, limited by instru- mentation

The TCS model, stated bluntly, is a reductionist approach to training. It is appealing because it simplifies a complex world: All variables which may interfere, interact, or intervene with the task are left out of the training thereby reducing the task to its simplest manageable and measurable elements. The problem is that the world and combat, as we have agreed, are not that simple, nor that kind to the ill-prepared. Things go wrong -- soldiers get lost, supplies get delayed, surprises occur. To top it off, someone is trying to kill you as you participate. These events are outside the scope of the TCS model, but are precisely the events soldiers (and at an integrated level, commanders) will encounter at JRTC and in combat.

A key point is that the TCS model is concerned only with measurable behavioral events. A substantial part of what transpires during combat is cognitive in nature -- planning, judgement, and decision making -- and is not easily measured. However, the importance of cognitive processes cannot be denied, try as the TCS model may. The question now is, where do we go from here to provide a more meaningful model for use with a complex simulation in which all events of interest may not be observable?

Alternatives to the TCS Model

After Action Reviews (AARs). The ACTFs have adopted the After Action Review (AAR) as the performance evaluation mode. In an AAR a commander's performance is critiqued on a mission by mission basis. The AAR is generally negative (although positive action reports do sometimes creep in), highlighting errors and failures. The instrumentation at the NTC is clearly an asset in conducting AARs — the discussion can focus on the "whys" of mission events. Without instrumentation it seems likely that AAR could stay at the level of "what" happened; this would severely reduce the effectiveness of the AAR as a learning/feedback tool.

One virtue of the AAR is that commanders receive timely feedback concerning their battlefield performance. Usually the AAR is given within several hours of completion of a mission so it is reasonable to assume that many of a commander's actions and decisions would still be relatively fresh in memory. The instrumentation is also a useful memory device. A second virtue of the AAR is that while systematically formatted, it is unstructured in comparison to TCS. The AAR can take on whatever form is necessary to document shortcomings, errors, and mission failures to commanders. Conversely, the segmented TCS model can only deal with specific, well-defined pieces of performance. It falls short when the pieces are integrated, and is nearly useless when measurement of performance is difficult or impossible due to lack of instrumentation.

The largest single problem with the AAR as a general tool is that it is private in nature. Information discussed during a review is not for public consumption. Hence, the many insights gained during the process are not distributed to all units. We would hope that the more important lessons would be distributed through "grapevines" or some other unofficial channel.

Lessons learned. Recently there has been an increased emphasis on documenting and distributing lessons learned. These are a compilation of errors, blunders, tricks, and helpful hints derived from observations and experiences from Vietnam, NTC, Grenada, and other field operational environments.

We feel that the development of the Center for Army Lessons Learned (CALL, Fort Leavenworth, KS) shows an intuitive awareness of the limits of the TCS model. The lessons learned model can act as an adjunct to AARs, and can serve as a vehicle to disseminate summaries of many observations across unit rotations. Through CALL performance errors and novel solutions become available to all commanders.

We feel that there are weaknesses in lessons learned as currently configured, however. One is the failure to document lessons adequately. That is, the lessons learned are generally void of the historical details which prompted the inclusion of the lesson in the first place. That is, there is no systematic problem statement or related historical context: just a solution(s). The need for lessons learned is obvious but they might better serve the Army if they reflected systematic development, analysis, and discussion of problems. They do not result from collecting numerous ideas and anecdotes to fill a booklet, they are the result of problem identification and noted relevant solutions. A second weakness is stated simply: There is a tendency to force the lessons learned into a TCS format. TCS already exists — there is no need to replicate it.

It should be clear that we opt for a change in the format of lessons learned to be more in accord with a true performance evaluation model. We will not say that this will be easy to do, but lessons learned is a powerful and important instrument and needs to carve out its own identity. With modification it will be more useful for units as a performance evaluation model.

IMPLICATIONS FOR JRTC

Given these observations on skill acquisition and sustainment procedures, TCS, AARs, and lessons learned, we can form initial expectations about what a center such as the JRTC can do for the soldier. First, what is the JRTC? Clearly, JRTC does not fit the traditional concept of a "training center" -- basic skills are not taught there. On the other hand, JRTC is not practice: We are integrating skills, examining execution, determining the adequacy of our training procedures, and scrutinizing tactics and techniques. JRTC is best characterized as a simulation, which means that we cannot expect training-type results (e.g., rapid learning) to emerge from each rotation. Nor can we make assertions concerning readiness based on performance alone. Instead, JRTC should be viewed in the light of a simulation: JRTC functions as a place to sharpen skills already learned, to integrate skills, to examine performance, and to determine how well our training, tactics, and techniques will transfer to a realistic combat environment.

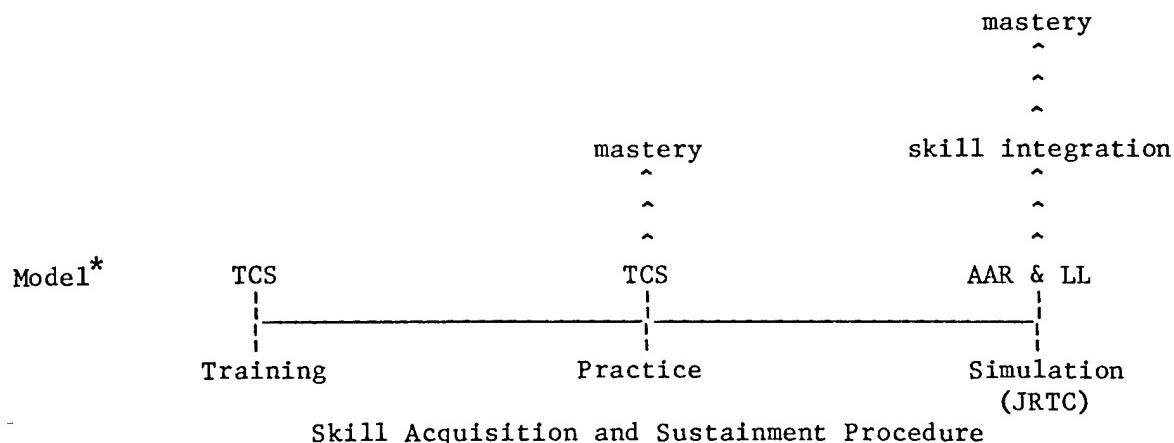
Evaluation of Performance

The result of this analysis is that the TCS model used during training and practice is not an appropriate performance evaluation tool at JRTC. Figure 1 will help to shed light on this assertion.

There are many skills that are necessary for soldiering. Knowledge of these skills does not make one a soldier, but they are necessary for successfully filling that role. The situation is similar to learning to walk: A prerequisite to walking is that you can keep your balance — however, being able to keep your balance does not mean that you can walk. TRADOC schools, using the TCS model, insure that soldiers can keep their balance. At JRTC, and NTC, soldiers are taught to walk. Of course, other field exercises and simulations do this as well. What makes the ACTFs unique is the possibility of doing so in a controlled environment where simulation components are all planned for.

Figure 1

Skill acquisition and sustainment procedure methods with performance measurement models.



* TCS refers to the Task-Condition-Standard performance measurement model
AAR refers to After Action Review
LL refers to Lessons Learned

During training, soldiers are exposed to the tasks in which they must eventually become proficient. All dimensions of the task are clearly laid out: what the task is, how to do it, and how good you must be at it. With practice the task is eventually mastered under the predetermined conditions. In general, during training and practice, the task is well-defined and the conditions are relatively constant. The standards are performance oriented and easily measured.

At JRTC however, there is no single task. Although there is a single mission (currently a global or collective task), many tasks are performed in parallel and it is clear that tasks are now highly interdependent. All of the basic soldiering skills learned by participants at all echelons must now be integrated. In addition, the conditions which were so clear and well-defined in training and practice are now in a constant state of flux because of changing battlefield conditions, resources, and materiel. With additional JRTC experience skill integration occurs and mastery over the combat simulation is obtained.

A two phase progression is evident: First, train the enabling skills and practice them to mastery. Then, simulate combat conditions, integrate the enabling skills and practice the integrated (higher level) skills to mastery. We see the role of JRTC as partially fulfilling the second part of this combat readiness formula.

Doctrine, Tactics, and Techniques Versus Training

As researchers and training developers we must be able to separate issues of tactics and techniques from issues of training. For example, a superb home station training program could result in bad performance if the wrong skills were trained (e.g., techniques). On the other hand, superb doctrine, tactics, and techniques could appear ineffective if it were poorly executed (bad training). If we look at JRTC performance in terms of doctrine (good or bad) and training (good or bad), only one case — good doctrine, good training — results in good JRTC performance. We face, in part, relatively unique combinations of new doctrine and training developed to make the U.S. Army Light Infantry forces highly effective. Some of the techniques and doctrine will evolve through exercising under the most critical evaluations possible. A critical research effort then, will be to determine what causes effective as well as ineffective performance at JRTC. The implied research task is to support the development of improvements to yield even more effective performance.

CONCLUSIONS

We feel that JRTC will experience growing pains with the early rotations and achieve success through evolution. This assertion should surprise no one, but, we hope that we indeed achieve growth, and not merely pains. An understanding of training, practice, and simulation and where JRTC fits into this scheme, gives us the power to conceptualize the level of analysis to approach JRTC from. What is critical is that an adequate model of performance evaluation be developed to insure that soldiers, training developers, and training evaluators get all they can from the JRTC experience. The AAR and lessons learned are in preliminary stages as performance evaluation models; as alternatives to the TCS model they should prove to be valuable foundations in developmental stages of JRTC and beyond.

It is almost ironic that while most defense spending is being directed toward armaments and training for heavier, mechanized units, we see an ever-increasing risk of deployment in the Low Intensity Conflict (LIC) environment. One of JRTC's goals to is prepare units for LIC through developing and testing of Light Infantry tactics under combat-like conditions. At the same time, JRTC hopes to insure that unit and

joint forces readiness is maintained. With a proper understanding of the capabilities and limitations of JRTC, and with the judicious use of performance evaluation, these and other goals can be easily obtained.

SUMMARY

Two major issues have been discussed. One concerns the type of training facility JRTC is. We conclude that it is best characterized as a large scale simulation of combat — it clearly does not fit the definition of a training environment since basic skills are not taught there. A second issue was the examination of various performance feedback models (e.g., TCS, AAR, and lessons learned) for their applicability to JRTC. We show that the TCS model, while appropriate in some training environments, is lacking as a performance feedback tool for JRTC since task conditions cannot be adequately specified. The AAR cannot be the sole source of performance evaluation since it is not a public event. Lessons learned offer the most flexibility in reporting, and with some revision, could be the major performance feedback evaluation model for the ACTFs.

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